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Dwarf Mistletoe Thinning Studies
Routt National Forest, Colorado

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Evaluation of Porcupine and Snyder Creeks Dwarf Mistletoe Thinning Studies Routt National Forest, Colorado

by

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Introduction

Lodgepole pine dwarf mistletoe (*Arceuthobium americanum* Nutt. ex Engelm.) is the most widely distributed and damaging disease of lodgepole pine (*Pinus contorta* Dougl.) in the central Rocky Mountains (Hawksworth and Johnson 1989; Johnson, Hawksworth and Drummond 1981). It has been estimated to infest more than half of the lodgepole pine in Colorado and Wyoming. The disease is most commonly controlled through silvicultural methods aimed at reducing the intensity and spread of the disease through the cutting of infected trees (Hawksworth and Johnson 1989; Hawksworth et al. 1977; Hawksworth and Wiens 1996). In 1972, a study was established in northcentral Colorado to test the feasibility of thinning infested lodgepole pine stands in order to reduce the intensity of the disease, to maintain stocking of suitable crop trees and carry the stands to rotation age (Brown 1972a; Brown 1972b; Brown 1975). Since these stands are in a timber emphasis area, the only alternative in many cases would be to replace the stands and regenerate them since no merchantable products would result if no effort was made to reduce the incidence of dwarf mistletoe.

The purpose of this report is to compare and discuss the post-treatment stand growth projections of the stands made in 1975 (Brown 1975) with the current conditions and discuss the impact of the thinning on reduction of dwarf mistletoe infestation.

Twenty-six years have passed since these stands have been remeasured, thus we were afforded an opportunity to gain some information on the efficacy of these treatments in reducing dwarf mistletoe infection and promoting tree growth.

Materials and Methods

Three lodgepole pine stands located on the Parks Ranger District, Routt National Forest (located at T5N, R77W, Sect. 30 and T6N, R77W, Sects. 23, 26) were selected as the study areas (Figures 1, 2 and 3). The stands (95, 125 and 20 acres in size) were precommercially thinned to a 10 by 10 foot spacing in 1972 leaving approximately 450 trees per acre (Table 1). The thinning contract specified that only those trees showing the most desirable characteristics be left for further growth. Spacing was only a guide to leave the best trees.

The residual stands were surveyed by Forest Pest Management personnel between 1972 and 1974 to determine the incidence of dwarf mistletoe and to collect stand data. The data was then run through the forest growth yield program LPMIST (now referred to as FVS - Forest Vegetation Simulator) to project yields into the future (Brown 1975; Meyers et al 1971).

Since the exact locations of the blocks within the stands that were surveyed in 1972-1974 were not known, sample blocks were chosen for remeasurement in July 1998. In the Snyder Creek area, wood posts noting the date of the thinning (1972) were relocated for blocks 4 and 5. These blocks were sampled as representative of the original thinning. A total of 19 sample points were located in these stands. For Porcupine Creek, the larger stands were sampled as representative of the original thinning. A total of 30 sample points were located in these stands. Each stand was surveyed with a 10 BAF (basal area factor) prism. Sample points were systematically located two chains apart along compass lines two chains apart. Each plot tree was measured for DBH (diameter at breast height) and species and DMR (Dwarf Mistletoe Rating - Hawksworth 1977) recorded. Site index (total height at 100 yrs.) was estimated by height measurement of dominant or codominant trees in each stand. For Porcupine Creek, six trees were measured for site; for Snyder Creek, four trees were measured. Site tree measurements included DBH, height, DMR, age (measured at stump height) and radial growth.

Results

Stand parameters before and after thinning Porcupine and Snyder Creek stands in 1972 are presented in Table 1. The Porcupine Creek stand was 27 years old at the time of thinning and was overstocked with nearly 2,700 trees per acre. The Snyder Creek stands were 70 years old and varied from nearly 900 to 4,300 trees per acre. All stands were thinned to an average of approximately 450 trees per acre. The dwarf mistletoe infection varied from 7 to 34 percent before thinning. Unfortunately, only the presence or absence of the disease was noted. DMR was not recorded.

Table 1. Description of stand conditions before and after thinning Porcupine and Snyder Creek stands, Routt National Forest.

Stand	Age (yrs.) (in 1972)	Trees/acre 1972	Trees/acre 1975	DM Infection (%) 1972	DM Infection (%) 1975	DMR 1/ 1975
Porcupine Cr.	27	2680	429	27	51	1.6
Snyder I	70	4330	529	34	30	1.3
Synder II	70	880	398	7	30	1.3

1/ From Brown's 1975 report.

The stand parameters for the blocks measured in July 1998 are presented in Table 2. The amount of dwarf mistletoe infection varied in the two blocks at Porcupine Creek from 35 to 76 percent.

For Snyder Creek, the amount of infection varied from 1 to 62 percent. To determine the actual intensity of the disease on only infected trees, the DMI or Dwarf Mistletoe Intensity was calculated. This indicated that the infected trees had light infections overall, ranging from a DMR of 1.5 to 1.8.

Table 2. Comparison of summary statistics for Porcupine and Snyder Creek stands, Routt National Forest (1998).

Stand	DBH (in.)	BA (sq. ft.)	DM infection (%)	DMR	DMI 1/
Porcupine Cr.1	5.6	89	35	0.6	1.8
Porcupine Cr.2	8.1	73	76	1.3	1.7
Snyder Cr.4	7.3	93	1	0.2	1.5
Snyder Cr.5	5.2	112	62	1.0	1.6

1/ DMI is Dwarf Mistletoe Intensity (average DMR of infested trees only).

Table 3 compares site index and growth rates for each stand as measured in July 1998. The Porcupine Creek stands were growing at a faster rate and had higher site indices than the Snyder Creek stands. The site indices for Porcupine Creek stands ranged from 79 to 80; whereas, Snyder Creek stands ranged from 54 to 59.

Table 3. Comparison of site tree data for Porcupine and Snyder Creek stands, Routt National Forest (1998).

Stand	Ht. (ft.)	DBH (in.)	Age (yrs)	Growth 1/ (in.)	S.I. 2/
Porcupine Cr.1	45	8.6	57	15/20	79
Porcupine Cr.2	43	8.4	54	16/20	80
Snyder Cr.4	53	8.9	98	10/20	54
Snyder Cr.5	42	5.3	73	4/20	59

1/ Radial growth estimated for last 10 yrs.
2/ Tree height at base age 100 years.

Originally the stands were thinned according to the specifications in the contract, which was administered by district personnel. Remeasurement of the stands between 1972 and 1974 revealed that the percent of lodgepole pine infected with dwarf mistletoe had increased after treatment in Porcupine Creek; whereas in Snyder Creek it had decreased slightly in one stand and increased in another (Table 1). According to Brown's 1975 report, there are several possible explanations. The most obvious is that quality control during the thinning operation was less than desired. Tree cutters may not have discriminated against dwarf mistletoe-infected trees or they missed lightly infected trees. If the larger trees in these stands were retained, they would have been the more highly infected trees. Another possibility is that estimates of the incidence of dwarf mistletoe both before and after treatment were inaccurate. It was noted in Brown's 1975 report that the pretreatment survey in Snyder Creek consisted of only six sample plots. The original data is presented in Table 1.

In order to contrast the current stand condition to that recorded in 1975, the individual stand data were combined for each area and are presented in Table 4.

Table 4. Summary stand statistics for Porcupine and Synder Creeks thinning studies, Routt National Forest (1972 and 1998).

Area	Age (yrs.)		DBH (in.)		BA (sq.ft.)		DM Infection (%)		DMR	
	1975	1998	1975	1998	1975	1998	1975	1998	1975	1998
Porcupine Cr.	27	53	2.8	7.6	18	85	51	43	1.6	1.8
Synder Cr.	70	96	3.3	6.8	31	92	30	0.2	1.3	0.4

In order to contrast the projected stand conditions made in 1975 with that actually measured in 1998, the LPMIST projection tables in Brown's 1975 report were interpolated to the current year (1998). The data is presented in Table 5.

Table 5. Comparison of yield projections from LPMIST (1975) to actual stand parameters (1998) for Porcupine and Snyder Creeks stands, Routt National Forest.

Stand	BA (sq.ft.)		Ave. DBH (in.)		DMR	
	Projected	Actual	Projected	Actual	Projected	Actual
Porcupine Cr.	60	85	5.2	7.6	3.2	1.8
Snyder Cr.	93	92	5.8	6.8	3.1	0.4

Discussion and Conclusions

The current level of infection for the stands, in general, for the combined Snyder Creek stands (0.2 percent trees infected, DMR 0.4) and Porcupine Creek stands (43 percent trees infected, DMR 1.8) is low to moderate and the disease has had little visible impact on growth at this time (Table 4). Research on the disease indicates that growth effects do not occur until the DMR is 3.0 or greater (Hawksworth and Johnson 1989). Research also indicates that the DMR increases to the next full rating at about 15 years, thus in another 30 years the DMR of Porcupine Creek will be about 3.8 and that of Snyder Creek about 2.4 if no additional stand treatments occur. At that time the stands will be of harvest size.

It is interesting to note that the younger stand in Porcupine Creek, which was thinned at age 27, has surpassed the growth of the older stand (70 years old at thinning) in Snyder Creek. The average diameter of the Porcupine Creek stand was 7.6 inches at breast height; whereas the Snyder Creek stand was 6.8 inches (Table 4) (Figures 4,5). The site index indicates that Porcupine Creek (average 79) is more productive than Synder Creek (average 56), also thinning at age 27 rather than 70 years is a better investment to capture the potential of the site.

The discrepancies noted in the LPMIST projections made in 1975 compared to the actual stand measurements made in 1998 could result from several factors (Table 5). First, there have been many adjustments and corrections made to the yield programs since 1975. Also, the site indices used for the original yield projections were lower than measured in 1998. The DMR's projected for the yield program are very close to those that would be expected to occur if the original survey data was correct; however, actual DMR's were not recorded in the 1972-1974 surveys, only presence or absence of the disease was noted. The DMR's used in the original projections (based on percent infected trees) may have been overestimated. The current stands have a much lower incidence of the disease than the projections would indicate. In fact, the DMI's (DMR of infected trees only) supports this (Table 2).

It appears that sanitation thinning of dwarf mistletoe-infested stands can reduce the impacts of the disease if stands have sufficient stocking of disease-free or lightly infected trees and the thinning is done in a timely manner. In these cases, both Porcupine and Snyder Creek stands had adequate stocking of disease-free and lightly infected trees at the time of the thinning and the thinnings were beneficial in reducing the disease and increasing residual tree growth. If the thinnings had not been conducted, the yield projections made in 1975 (Brown 1975) showed that the stands would not reach merchantable size at 130 years and the dwarf mistletoe ratings would be sufficiently high to have a detrimental impact on growth and mortality of these stands (Table 6).

Table 6. Projected stand parameters and yields for Porcupine and Snyder Creek stands with no treatment, Routt National Forest 1/.

Stand (age)	Trees/acre (no.)	BA (sq.ft.)	Ave. DBH (in.)	DMR	Total volume (cu.ft)
Porcupine Cr. (127)	516	123	6.6	6.0	2,460
Snyder Cr. (130)	1,586	153	4.2	4.2	2,730

1/ From Brown's 1975 report.

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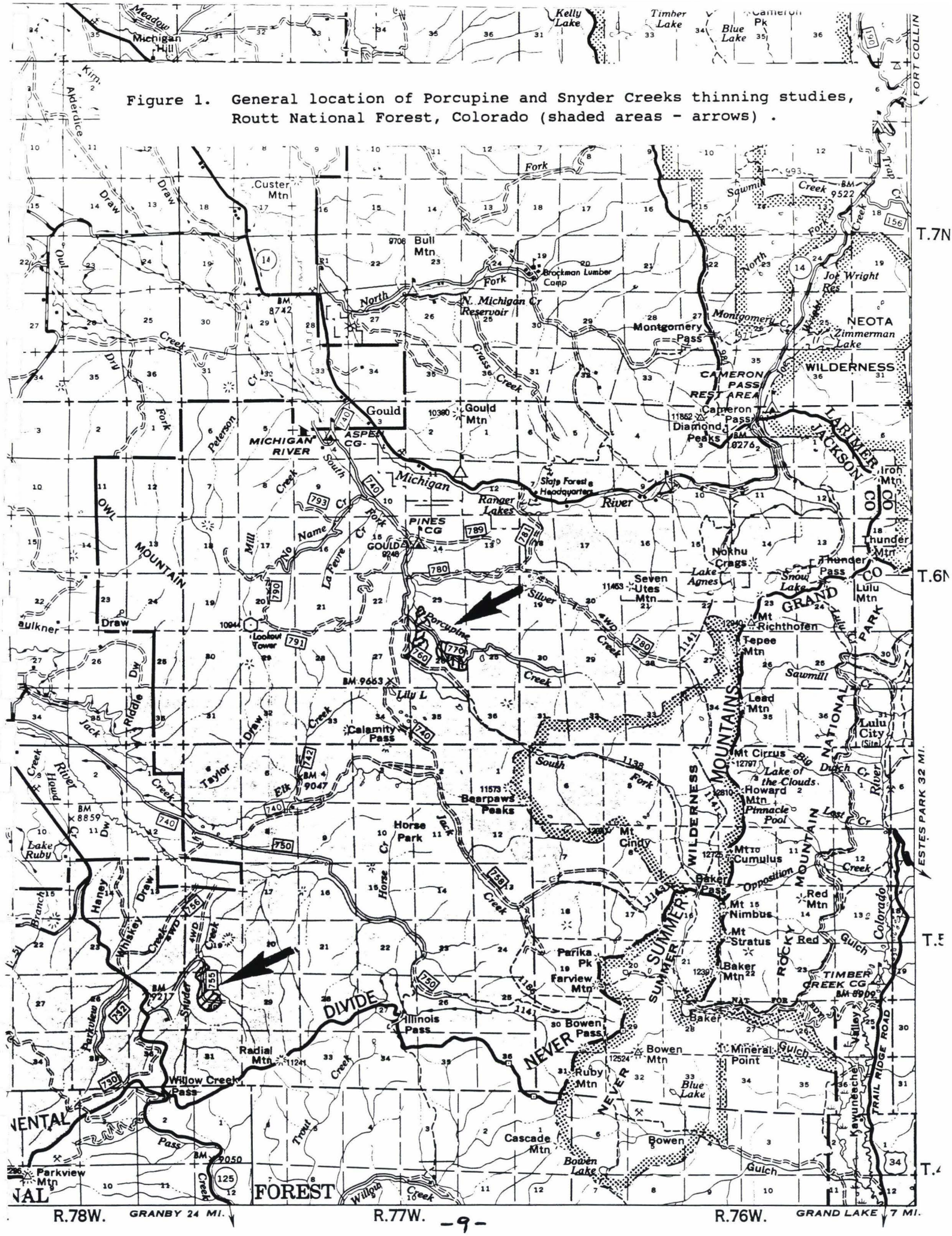

Figure 1. General location of Porcupine and Snyder Creeks thinning studies, Routt National Forest, Colorado (shaded areas - arrows) .

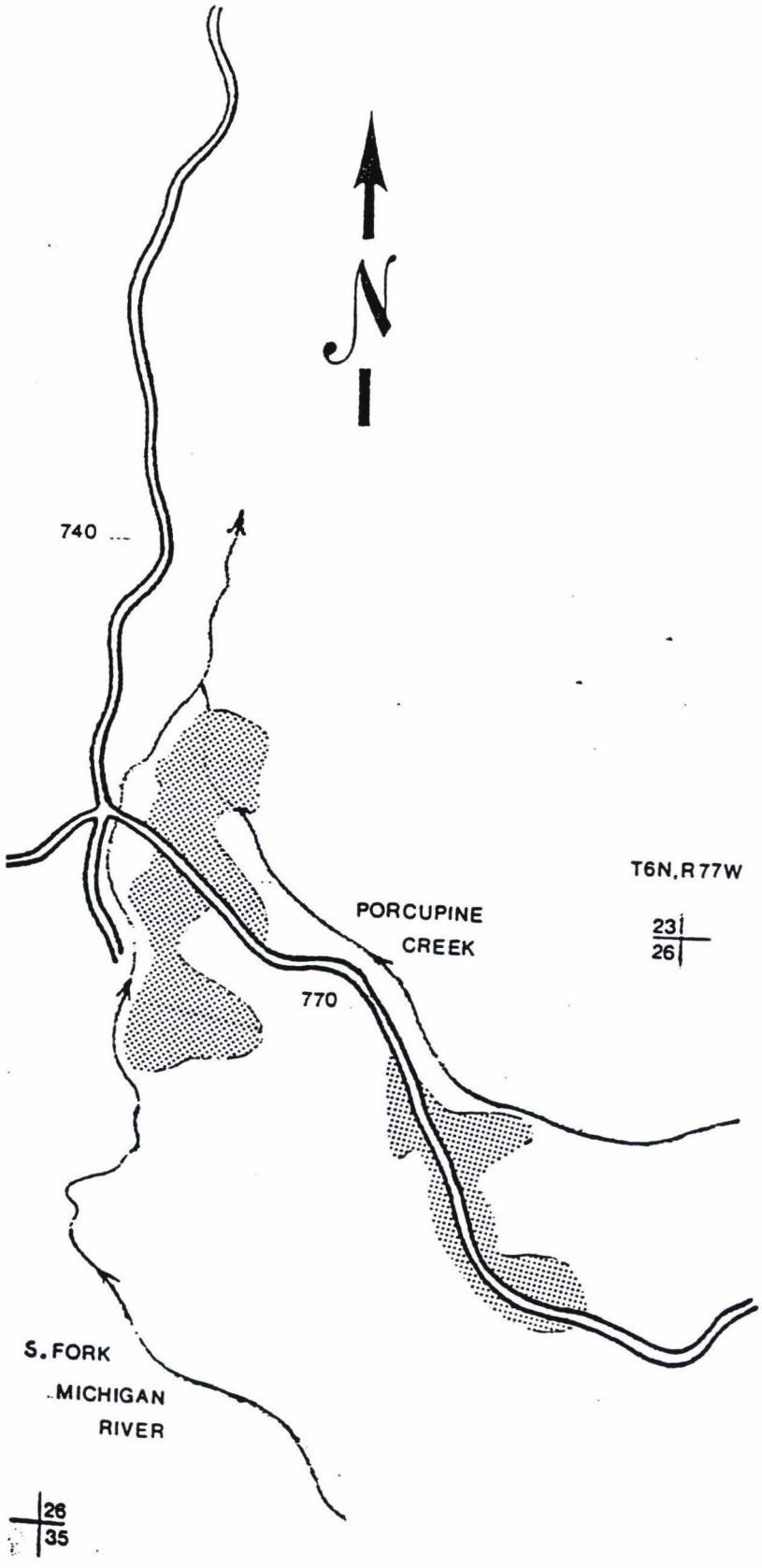

Figure 2. Location of Porcupine Creek thinning study, Routt National Forest, Colorado.

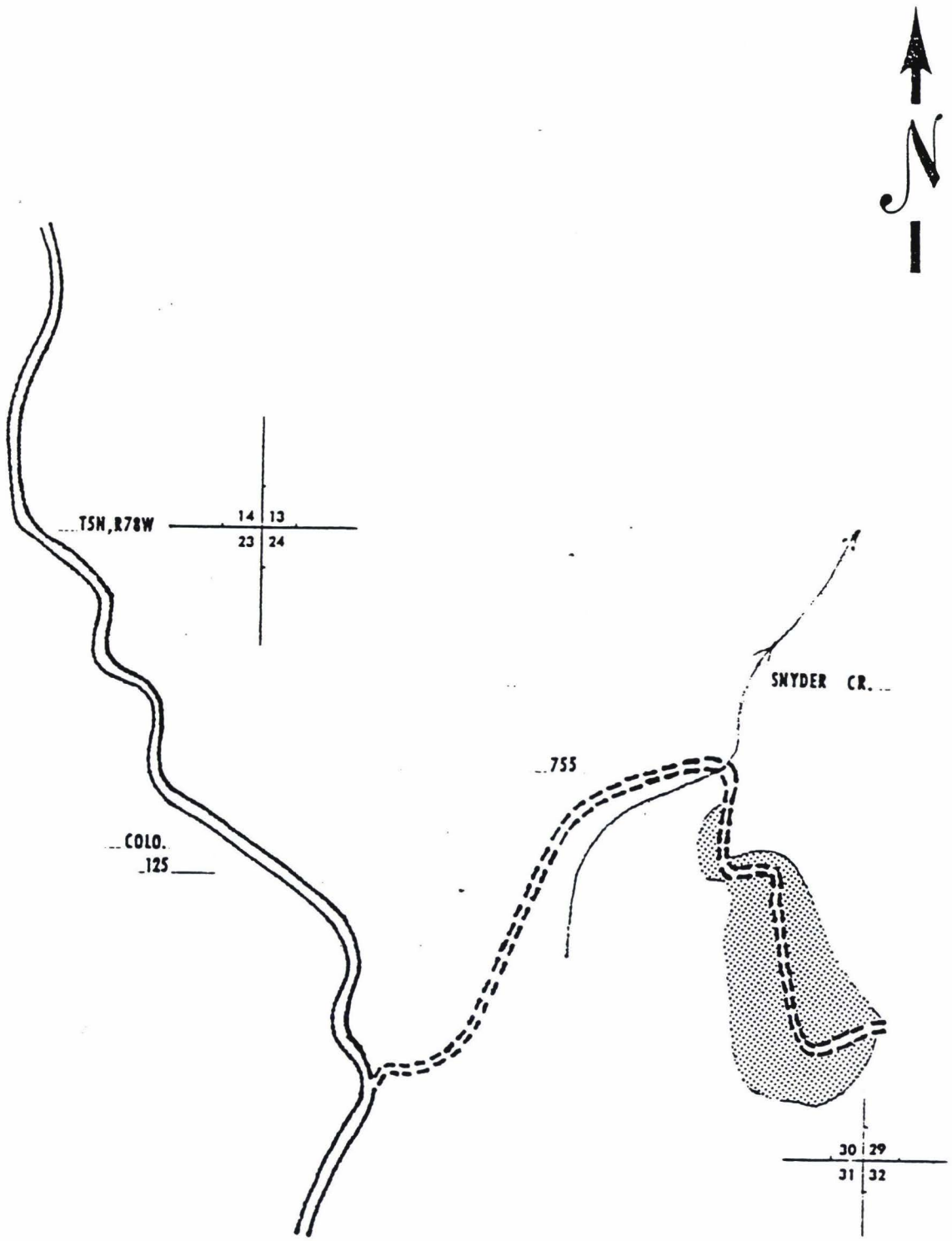

Figure 3. Location of Snyder Creek thinning study, Routt National Forest, Colorado.

Figure 4. Porcupine Creek thinning study area, Routt National Forest, 1998.

Figure 5. Snyder Creek thinning study area, Routt National Forest, 1998.